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Parental age difference and offspring count in humans

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Preferences for certain age characteristics of partners are reported across cultures: men prefer mates who are younger and women prefer mates older than themselves. To examine whether these age preferences entail fitness effects for men and women, we investigated the association among age differences between partners and offspring count. On the basis of a sample of approximately 10 000 post-reproductive Swedish men and women who did not change their partner between the birth of their first and last child, we find maximum offspring count in men if their partner is approximately 6 years younger, and in women if their partner is approximately 4 years older. We further find that after separation, on average, both men and women shift to a partner younger than the first, albeit in women the new partner is still older than the female herself. We conclude that the age preference for the partner yields fitness benefits for both men and women and may thus be an evolutionarily acquired trait.

Keywords: mating; reproduction; age; preference; male; female

1. INTRODUCTION

Successful mating is crucial for the individual on a proximate as well as ultimate level: those who have never reproduced are not in the line of ancestors (Buss 2006). Mate selection is an inevitable precondition for mating success. In humans, women typically tend to select their mates based on their willingness and potential to protect and invest in herself and her offspring using criteria such as resources, financial prospect, status and physical appearance (Buss 1994; Pawlowsky *et al.* 2000). Men primarily desire physically attractive partners (Buss 2006). In line with this preference, men usually mate with women younger than themselves; this pattern seems to be culturally universal, although the extent of the age difference between the partners varies (Buss 1989) and depends on the men's age (Kenrick *et al.* 1996). Women, in contrast, who place more emphasis on the resources and status of their mates, typically mate with men older than themselves; again, this pattern appears to be culturally universal (Buss 1989).

To examine whether preferences for certain age characteristics of the partner entail any fitness effects for men and women, we investigated the association between the age difference between partners and reproductive output, based on a sample of post-reproductive Swedish men and women who did not change their partner between the birth of their first and last child. Using another sample of post-reproductive Swedish men and women, who did change their partners between the birth of their first and last child, we further compared the age difference between the individual and his/her original versus new partner to examine whether age preferences shift with ageing.

2. MATERIAL AND METHODS

We used a representative dataset of 5623 Swedish men and 5999 Swedish women from the Total Population Register of the year 2000, obtained from Statistics Sweden. The sample has been matched by Statistics Sweden with the Multigeneration Register, Register of Population Changes, Register of Income and Wealth and Register of Education. The sample contains only reproducing individuals born between 1945 and 1955, who are thus aged 45–55 years. This yields data about lifetime reproductive success because, in this sample, more than 99.7% of women and more than 96.5% of men had completed reproduction by the age of 45 years. The main advantage of this dataset is that it is one of the very few that include highly accurate data about offspring count of both men and women. The created file has been depersonalized and contains the following variables: sex; number of biological children born up to 2003; and year and month of birth of all 5623 men and 5999 women in the sample as well as year and month of birth of these individuals' partners at the time of birth of their first and last child, respectively. We defined 'partner' as the person who was registered as the other parent at the time of birth of these individuals' first and last child, irrespective of marital status.

We performed each statistical analysis separately for men and women. (i) Including only individuals in the analyses who did not change their partner between the birth of their first and last child, we calculated the average offspring count for each age difference between the partners. We aggregated age differences exceeding 10 years. We calculated a quadratic regression in the form of $Y = a + b \times x + c \times x^2$, either on average offspring count per age difference (in years) or on individual offspring count per age difference (in months). The latter yielded the optimal age difference associated with maximal offspring count. To consider potential confounding effects of the partner's age, we further performed multiple regression in the form of $Y = a + b \times x + c \times x_1 + d \times x_1^2$ with x representing the age of the partner in the year 2003 and x_1 the age difference between the partners. (ii) Including only individuals in the analysis who changed their partner between the birth of their first and last child, we compared the age difference between an individual and his/her original (i.e. the other parent at the time of birth of the individual's first child) versus new partner (i.e. the other parent at the time of birth of the individual's last child) with the Mann–Whitney *U*-test. The significance level was set at 0.05.

3. RESULTS

Including only those individuals who did not change their partner, we found that—in the male sample—the average offspring count decreased, the older the female partner is compared with the male (figure 1; quadratic regression of the age difference in years between the male and female partner on the average offspring count of men: best fit $= 2.10242 - 0.0406783 \times - 0.00364228x^2$; adjusted $R^2 = 0.893$, $F = 92.417$, $p < 0.0001$, $n = 4851$). Applying a quadratic regression to all individual data points of the male dataset, the regression curve has its maximum at -5.92. Accordingly, if the female partner is 5.92 years younger than the male, offspring count is at the maximum (quadratic regression of the age difference in months between the male and female partner on offspring count of men: best fit $= 2.13155 - 0.0387471x - 0.00327036x^2$; adjusted $R^2 = 0.017$, $F = 43.097$, $p < 0.0001$, $n = 4851$). Using multiple regression, both partner's age and age difference between the partners are significantly negatively associated with offspring

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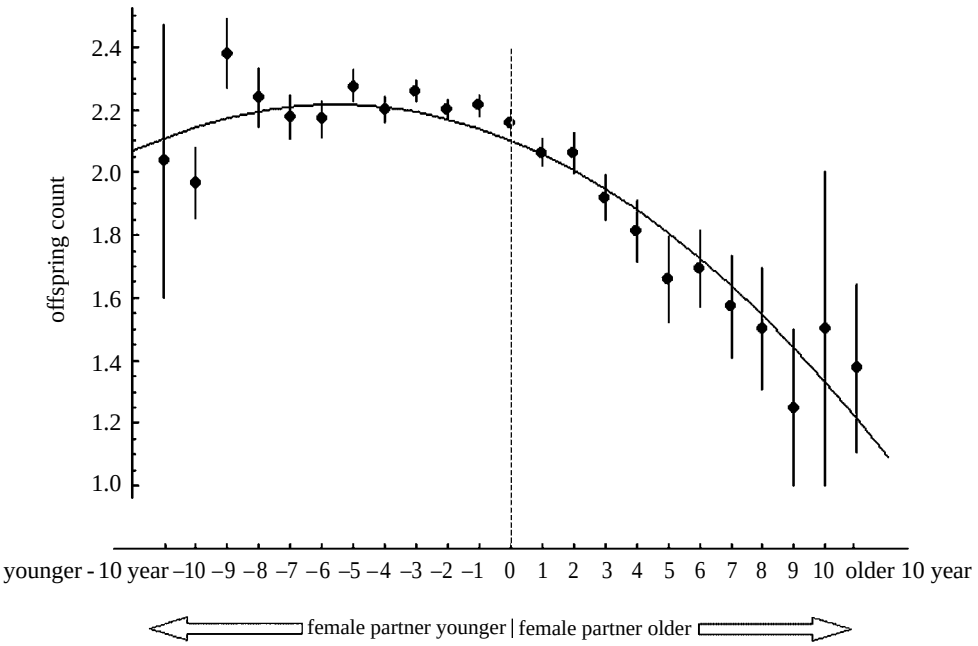

Figure 1. Mean offspring count (±s.e.) of Swedish men aged 45–55 years who did not change their partner between the birth of their first and last child versus age difference in years between the individual and his female partner as well as quadratic regression of means. Data for age difference more than 10 years are aggregated.

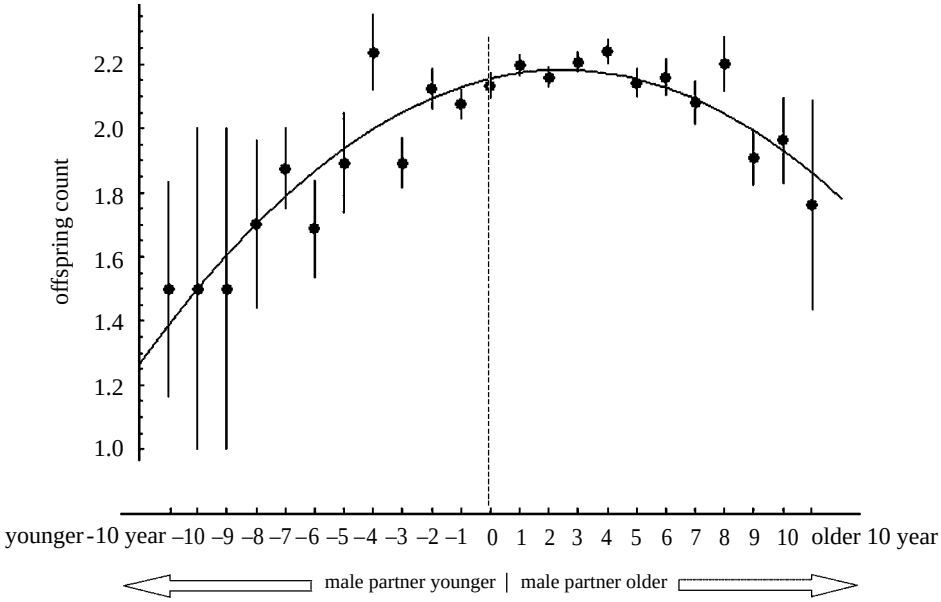

Figure 2. Mean offspring count (±s.e.) of Swedish women aged 45–55 years who did not change their partner between the birth of their first and last child versus age difference in years between the individual and her male partner as well as quadratic regression of means. Data for age difference more than 10 years are aggregated.

count (quadratic regression of the partner's age in the year 2003 and the age difference in months between the male and female partner on offspring count of men: best fit $=2.91199-0.0148055x-0.0241897x_1-0.00333042x_1^2$; adjusted $R^2=0.02$, $F=33.681$, $p<0.0001$, $t(x)=-3.82$, $p<0.001$, $t(x_1)=-4.18$, $p<0.001$, $t(x_1^2)=-7.86$, $p<0.001$, $n=4851$).

Similarly, in the female sample, we found that the average offspring count decreased, the older the female partner is compared with the male, except for partnerships where the female is more than 5 years younger than the male (figure 2; quadratic regression of the age difference in years between the male and female partner on the average offspring count of women: best fit $=2.1559+0.0216044x-0.0040166x^2$; adjusted $R^2=0.837$, $F=57.541$, $p<0.0001$, $n=5219$). Applying a quadratic regression to all individual female data, the regression curve has its maximum at +3.97. Accordingly, if the male partner is 3.97 years older than the female, offspring count is at the maximum (quadratic regression of the age difference in months between the male and female partner on offspring count of women: best fit $=2.14067+0.0185834x-0.00234228x^2$; adjusted $R^2=0.008$, $F=22.098$, $p<0.0001$, $n=5219$). Using multiple regression, the partner's age is significantly negatively associated but the age difference between the partners is significantly positively associated with offspring count (quadratic

regression of the partner's age in the year 2003 and the age difference in months between the male and female partner on offspring count of men: best fit $=2.8235-0.0129233x+0.0307584x_1-0.00236355x_1^2$; adjusted $R^2=0.01$, $F=18.64$, $p<0.0001$, $t(x)=-3.46$, $p<0.001$, $t(x_1)=5.22$, $p<0.001$, $t(x_1^2)=-6.62$, $p<0.001$, $n=5219$).

We further found that men who changed their partner after the birth of their first child ended up with a significantly younger partner when the last child was born (mean age difference ($\pm$s.e.) between male and female partner at the time of birth of the male's first versus last child: -1.74 ± 0.12 versus -6.10 ± 0.19 years; Mann–Whitney U-test, $n_1=772$, $n_2=772$, $U=139\,379$, $p<0.0001$). Women also ended up with a significantly younger partner although the new partner was, on average, older than the female herself (mean age difference ($\pm$s.e.) between the female and male partner at the time of birth of the female's first versus last child: 3.18 ± 0.13 versus 0.90 ± 0.20 years; Mann–Whitney U-test, $n_1=780$, $n_2=780$, $U=216\,479$, $p<0.0001$).

4. DISCUSSION

We show that the offspring count of both men and women who did not change their partner (i.e. the other parent) between the birth of their first and last child increased, the younger the female partner was compared with the male. The age difference between the partners yielded a maximum offspring count for men, if the female partner was approximately 6 years younger than the male and for women if the male partner was approximately 4 years older than the female. These findings may account for the phenomenon that men typically prefer and mate with women younger than themselves, whereas women usually desire and mate with men older than themselves (Buss 1989; Kenrick & Keefe 1992).

The highest level of reproductive success was found for men with partners approximately 6 years younger which, however, is considerably higher than the average age preference found across cultures—a 2.66 years-younger partner (Buss 1989). Only in Nigeria has a preferred age difference of more than 6 years been reported (Buss 1989). We attribute this discrepancy between the reported age preference and the optimum age difference found in the present study to the fact that as men grow older, they prefer and actually mate with increasingly younger women (Kenrick & Keefe 1992; Kenrick *et al.* 1996). In women, on the other hand, the observed optimum of an approximately 4 year-older partner is only slightly higher than the average preference of a 3.42 year-older partner reported across cultures (Buss 1989). Correspondingly, in contrast to ageing men, women do not show a shift in their age preferences as they grow older (Kenrick & Keefe 1992; Kenrick *et al.* 1996). The drop in offspring count found in women mated with a considerably younger partner may at least partly be attributed to a shorter reproductive period in these women because, on average, they may have started reproduction at an older age. Similarly, a shorter fertility period left may also account for the reduced offspring count found in men mated with considerably older women. The multivariate analysis yielded highly significant effects of both the age difference and the partner's age on offspring count, the latter indicating a cohort effect: on average, the younger individuals in our sample have more offspring than older ones. We attribute this phenomenon to the sharp increase of the total fertility rate in Sweden during the late 1980s (Andersson 1999), which has a stronger effect on the younger individuals in our sample. We further show that in individuals who do change their partner between the birth of their first and last child, the partner at the time of the latter birth is significantly younger than the partner at the time of the former birth. This holds true both for men and women: men shift to a much younger partner, women shift to a partner less old than the first. These findings support the reported age preferences of ageing men for increasingly younger women as well as of women for a partner just a little older than themselves (Kenrick & Keefe 1992). We attribute the shift to a younger partner to a potential compensation for the fertility loss caused by the individuals' increasing age to reduce the risk of declining couple fecundity (Kidd *et al.* 2001; Dunson *et al.* 2004).

We conclude that the age preference for the partner increases individual fitness of both men and women and may thus be an evolutionarily acquired trait.

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